

YAGUANG YANG

SPACECRAFT MODELING, ATTITUDE DETERMINATION, AND CONTROL

Quaternion-Based Approach



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A SCIENCE PUBLISHERS BOOK

Spacecraft Attitude Determination And Control

Murlidhar Rajagopalan



Spacecraft Attitude Determination And Control:

Spacecraft Attitude Determination and Control James R. Wertz, 1978-12-31 Roger D Werking Head Attitude Determination and Control Section National Aeronautics and Space Administration Goddard Space Flight Center Extensive work has been done for many years in the areas of attitude determination attitude prediction and attitude control During this time it has been difficult to obtain reference material that provided a comprehensive overview of attitude support activities This lack of reference material has made it difficult for those not intimately involved in attitude functions to become acquainted with the ideas and activities which are essential to understanding the various aspects of spacecraft attitude support As a result I felt the need for a document which could be used by a variety of persons to obtain an understanding of the work which has been done in support of spacecraft attitude objectives It is believed that this book prepared by the Computer Sciences Corporation under the able direction of Dr James Wertz provides this type of reference This book can serve as a reference for individuals involved in mission planning attitude determination and attitude dynamics an introductory textbook for students and professionals starting in this field an information source for experimenters or others involved in spacecraft related work who need information on spacecraft orientation and how it is determined but who have neither the time nor the resources to pursue the varied literature on this subject and a tool for encouraging those who could expand this discipline to do so because much remains to be done to satisfy future needs [Fundamentals of Spacecraft Attitude Determination and Control](#) F. Landis Markley, John L. Crassidis, 2014-05-31 This book explores topics that are central to the field of spacecraft attitude determination and control The authors provide rigorous theoretical derivations of significant algorithms accompanied by a generous amount of qualitative discussions of the subject matter The book documents the development of the important concepts and methods in a manner accessible to practicing engineers graduate level engineering students and applied mathematicians It includes detailed examples from actual mission designs to help ease the transition from theory to practice and also provides prototype algorithms that are readily available on the author's website Subject matter includes both theoretical derivations and practical implementation of spacecraft attitude determination and control systems It provides detailed derivations for attitude kinematics and dynamics and provides detailed description of the most widely used attitude parameterization the quaternion This title also provides a thorough treatise of attitude dynamics including Jacobian elliptical functions It is the first known book to provide detailed derivations and explanations of state attitude determination and gives readers real world examples from actual working spacecraft missions The subject matter is chosen to fill the void of existing textbooks and treatises especially in state and dynamics attitude determination MATLAB code of all examples will be provided through an external website **Spacecraft Attitude Determination and Control** James R. Wertz, 1980 *Spacecraft Attitude Determination and Control* Computer Sciences Corporation. Attitude Systems Operation, 1978 *Fundamentals of Spacecraft Attitude Determination and Control* F. Landis

Markley, John L. Crassidis, 2014-06-01 This book explores topics that are central to the field of spacecraft attitude determination and control. The authors provide rigorous theoretical derivations of significant algorithms accompanied by a generous amount of qualitative discussions of the subject matter. The book documents the development of the important concepts and methods in a manner accessible to practicing engineers, graduate level engineering students and applied mathematicians. It includes detailed examples from actual mission designs to help ease the transition from theory to practice and also provides prototype algorithms that are readily available on the author's website. Subject matter includes both theoretical derivations and practical implementation of spacecraft attitude determination and control systems. It provides detailed derivations for attitude kinematics and dynamics and provides detailed description of the most widely used attitude parameterization, the quaternion. This title also provides a thorough treatise of attitude dynamics including Jacobian elliptical functions. It is the first known book to provide detailed derivations and explanations of state attitude determination and gives readers real world examples from actual working spacecraft missions. The subject matter is chosen to fill the void of existing textbooks and treatises especially in state and dynamics attitude determination. MATLAB code of all examples will be provided through an external website. **Spacecraft Attitude Control Program** Murlidhar Rajagopalan, 1996

Spacecraft Attitude Determination and Control J.R. Wertz, 2012-12-06 Roger D. Wertz, Head, Attitude Determination and Control Section, National Aeronautics and Space Administration, Goddard Space Flight Center. Extensive work has been done for many years in the areas of attitude determination, attitude prediction and attitude control. During this time it has been difficult to obtain reference material that provided a comprehensive overview of attitude support activities. This lack of reference material has made it difficult for those not intimately involved in attitude functions to become acquainted with the ideas and activities which are essential to understanding the various aspects of spacecraft attitude support. As a result, I felt the need for a document which could be used by a variety of persons to obtain an understanding of the work which has been done in support of spacecraft attitude objectives. It is believed that this book prepared by the Computer Sciences Corporation under the able direction of Dr. James Wertz provides this type of reference. This book can serve as a reference for individuals involved in mission planning, attitude determination and attitude dynamics, an introductory textbook for students and professionals starting in this field, an information source for experimenters or others involved in spacecraft related work who need information on spacecraft orientation and how it is determined but who have neither the time nor the resources to pursue the varied literature on this subject, and a tool for encouraging those who could expand this discipline to do so because much remains to be done to satisfy future needs. **Spacecraft Modeling, Attitude Determination, and Control**

Yaguang Yang, 2019-02-06 This book discusses all spacecraft attitude control related topics, spacecraft including attitude measurements, actuator and disturbance torques, modeling spacecraft attitude determination and estimation, and spacecraft attitude controls. Unlike other books addressing these topics, this book focuses on quaternion based methods because of its

many merits The book lays a brief but necessary background on rotation sequence representations and frequently used reference frames that form the foundation of spacecraft attitude description It then discusses the fundamentals of attitude determination using vector measurements various efficient including very recently developed attitude determination algorithms and the instruments and methods of popular vector measurements With available attitude measurements attitude control designs for inertial point and nadir pointing are presented in terms of required torques which are independent of actuators in use Given the required control torques some actuators are not able to generate the accurate control torques therefore spacecraft attitude control design methods with achievable torques for these actuators for example magnetic torque bars and control moment gyros are provided Some rigorous controllability results are provided The book also includes attitude control in some special maneuvers such as orbital raising docking and rendezvous that are normally not discussed in similar books Almost all design methods are based on state spaced modern control approaches such as linear quadratic optimal control robust pole assignment control model predictive control and gain scheduling control Applications of these methods to spacecraft attitude control problems are provided Appendices are provided for readers who are not familiar with these topics

Spacecraft Modeling, Attitude Determination, and Control Yaguang Yang, 2025-06-25 This book discusses spacecraft attitude control related topics spacecraft modeling spacecraft attitude determination and estimation and spacecraft attitude controls Unlike other books addressing these topics this book focuses on quaternion based methods because of their many merits It provides a brief but necessary background on rotation sequence representations and frequently used reference frames that form the foundation of spacecraft attitude description It then discusses the fundamentals of attitude determination using vector measurements various efficient including very recently developed attitude determination algorithms and the instruments and methods of popular vector measurements With available attitude measurements attitude control designs for inertial point and nadir pointing are presented in terms of required torques which are independent of actuators in use Given the required control torques some actuators are not able to generate the accurate control torques therefore spacecraft attitude control design methods with achievable torques for these actuators for example magnetic torque bars and control moment gyros are provided Some rigorous controllability results are provided The book also includes attitude control in some special maneuvers and systems such as orbital raising docking and rendezvous and multi body space systems that are normally not discussed in similar books All design methods are based on state spaced modern control approaches such as linear quadratic optimal control robust pole assignment control model predictive control and gain scheduling control Applications of these methods to spacecraft attitude control problems are provided Appendices are provided for readers who are not familiar with these topics

ADCS - Spacecraft Attitude Determination and Control Michael Paluszek, 2023-04-27 ADCS Spacecraft Attitude Determination and Control provides a complete introduction to spacecraft control The book covers all elements of attitude control system design including kinematics dynamics orbits

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